

Title: Comparing Methods of Linking Asthma Data from a Population-Based Survey with Ozone Data from Ambient Monitors at the Zip Code Level

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Background: Linking health and environmental data is an essential step in environmental public health tracking. While health effect data is often only available at the zip code level, zip codes vary greatly in size, shape, and population distribution. The quality of linkages between air monitoring data and asthma outcomes may be improved by considering these factors.

Objective: We tested methods for linking zip codes of California Health Interview Survey 2001 (CHIS) respondents diagnosed with asthma to ambient ozone data from 15 monitoring stations in Los Angeles.

Methods: We used four different methods to link zip codes to the nearest station based on either: 1) consideration of distance, topographical, and meteorological factors; 2) within 5 miles of the zip code population centroid; 3) within 5 miles of the zip code geometric centroid; 4) whether at least 60% of the zip code area fell within a 5-mile radius of the station. We calculated annual average ambient ozone concentrations based on measurements from each respondent's nearest linked monitoring station. For each linkage method, we estimated the effect of elevated ozone concentration on uncontrolled asthma (daily/weekly symptoms, asthma-related emergency department visit, or hospitalization), adjusting for age, gender, race/ethnicity, poverty level, and health insurance status. The odds ratios (ORs) from these methods were compared with the OR based on linking cross-streets to the nearest station within 5 miles.

Results: Uncontrolled asthma prevalence increased with elevated ozone concentration using the cross-street-based linkage. ORs for zip code linkages based on distance, topographical, and meteorological factors and the population centroid were most similar to the cross-street-based result.

Conclusion: Linkage methods that consider distance, population concentration, topography, and/or meteorology at the zip-code-level may be more accurate than simpler methods.

Evaluation: These study findings contribute to the development of methods for linking health surveillance and environmental hazard data.

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